

# James B. Elliott

JBelliott@lbl.gov

Lawrence Berkeley National Laboratory  
Mail Station 88  
1 Cyclotron Road  
Berkeley, CA 94720 USA

office: (510) 486-7962  
fax: (510) 486-7983  
home: URL: <http://www.lbl.gov/~jbe>

## Education

- |                    |   |
|--------------------|---|
| <i>June 1996</i>   | Complex Systems Summer School, Santa Fe Institute   |
| <i>June 1995</i>   | Seventh Nuclear Physics Summer School, University of Washington                               |
| <i>1988 – 1995</i> | Graduate School Purdue University. Ph.D. in Physics, May 1995; M.S. in Physics, December 1990 |
| <i>1983 – 1988</i> | Undergraduate at University of Illinois. B.S. in Astronomy and Physics, May 1988              |

## Research Interests

### Nuclear multifragmentation

- Critical behavior manifested in fragment distributions
- Signatures of phase transitions in dynamical information
- Models and simulations of excited nuclei

### Percolation

- Critical behavior manifested in cluster distributions
- Finite size effects
- Connections of phase transitions in physical systems

### Ising model

- Critical behavior manifested in cluster distributions
- Effects of lattice size and boundary conditions on phase diagram
- Effects of long range forces

### Phase transitions in novel systems

- Nuclear matter
- Traffic flow
- Tractable/intractable problems

### Computer Skills

BASIC, C, C++, Emacs, FORTRAN, HTML, LaTeX, PAW, TopDrawer, TPU, UNIX, VMS

### Employment

<i>February 2002 – Present</i>	Staff Scientist, Nuclear Science Divisions, Lawrence Berkeley National Laboratory, Berkeley, CA
<i>February 1999 – January 2002</i>	Post Doctoral Research Associate, Nuclear Science Division, Lawrence Berkeley National Laboratory, Berkeley, CA
<i>June 1995 – January 1999</i>	Post Doctoral Research Associate, Physics Department, Purdue University, West Lafayette, IN
<i>August 1991 – May 1995</i>	Graduate Research Assistant, Physics Department, Purdue University, West Lafayette, IN
<i>May 1990 – December 1991</i>	Graduate Teaching Assistant, Physics Department, Purdue University, West Lafayette, IN
<i>May 1990 – August 1990</i>	Summer Research Assistant, PRIME Lab, Purdue University, West Lafayette, IN
<i>August 1989 – May 1990</i>	Graduate Teaching Assistant, Physics Department, Purdue University, West Lafayette, IN
<i>May 1989 – August 1989</i>	Summer Research Assistant, PRIME Lab, Purdue University, West Lafayette, IN
<i>August 1988 – May 1989</i>	Programmer, Physics Department, Purdue University, West Lafayette, IN
<i>May 1988 – August 1988</i>	Undergraduate Research Assistant, Physics Department, University of Illinois, Urbana-Champaign, IL

### Research Projects

*1990 to present*

#### **Nuclear multifragmentation**

Nuclear multifragmentation is the break up of an excited nucleus into several intermediate mass fragments. The exact mechanism for this breakup is the subject of much study in the intermediate energy nuclear physics community.

My work, first with the Purdue High Energy Nuclear Physics Group and then with the Lawrence Berkeley National Laboratory Complex Fragments Group, has provided evidence that an excited nucleus behaves similarly to a droplet of ordinary water undergoing a phase transition from a liquid to a vapor, and has lead to the determination of several parameters associated with such a phase transition, e.g. critical exponents and the critical temperature.

- 1990 – 1992*      **EOS Collaboration**  
 As a member of the EOS experimental collaboration it was my responsibility to refurbish, and maintain, a scintillator based Time of Flight detector (ToF), monitor its performance during our data taking, and develop the associated analysis software.
- 1990 to present*      **Percolation**  
 In the course of my thesis research at Purdue University I developed techniques to determine critical exponents and observe universal scaling behavior in the cluster distributions of small percolation lattices. This work was the testing ground for the later analysis of experimental nuclear fragment yield distributions.
- 1988 – 1990*      **PRIME Lab**  
 As a graduate student at Purdue University I assisted in the development of the computer graphics interface of the data acquisition system and accelerator controller for the Accelerator Mass Spectrometry program at Purdue University headed by Professor David Elmore.
- 1987 – 1988*      **Semiconducting polymer diodes**  
 As an undergraduate in the University of Illinois Physics Department, I participated in the research and development of semiconducting polymer diodes at Fermi National Accelerator Laboratory (FNAL) in collaboration with Professor Steve Errede and the University of Illinois High Energy Physics department.

#### Teaching experience

- Summer 1990 - Fall 1991*      Head teaching assistant for laboratory of introductory astronomy course: developed laboratory exercises and coordinated laboratory sessions
- Spring 1990*      Teaching assistant for laboratory section of general introductory electricity and magnetism course
- Spring 1990*      Teaching assistant for laboratory section of introductory astronomy course
- Fall 1989*      Undergraduate physics help center instructor

#### References

- Luciano G. Moretto*      Professor, Department of Chemistry  
 University of California, Berkeley, CA 94720  
 Staff scientist, Nuclear Science Division  
 Lawrence Berkeley National Laboratory, Berkeley, CA 94720  
 LGMoretto@lbl.gov, (510) 486-5510
- Andrew S. Hirsch*      Professor/Department Chair, Department of Physics  
 Purdue University, West Lafayette, IN 47917  
 hirsh@physics.purdue.edu, (765) 494-3000

<i>Gordon J. Wozniak</i>	Staff scientist, Nuclear Science Division Lawrence Berkeley National Laboratory, Berkeley, CA 94720 GJWozniak@lbl.gov, (510) 486-5071
<i>Norbert T. Porile</i>	Professor, Department of Chemistry Purdue University, West Lafayette, IN 47917 porile@herald.cc.purdue.edu, (765) 494-5329
<i>Mark L. Tincknell</i>	Staff scientist, Lincoln Laboratory Massachusetts Institute of Technology, Lexington, MA 02420 tincknell@ll.mit.edu, (781) 981-5500
<i>Hans Georg Ritter</i>	Staff scientist, Nuclear Science Division Lawrence Berkeley National Laboratory, Berkeley, CA 94720 HGRitter@lbl.gov, (510) 486-4138
<i>Hisao Nakanishi</i>	Professor, Department of Physics Purdue University, West Lafayette, IN 47917 hisao@physics.purdue.edu, (765) 494-5522
<i>Gulshan Rai</i>	Staff scientist, Nuclear Science Division Lawrence Berkeley National Laboratory, Berkeley, CA 94720 GRai@lbl.gov, (510) 486-7125

**Publications: primary author**

*Constructing the phase diagram of finite neutral nuclear matter*, J. B. Elliott *et al.* submitted to Phys. Rev. C (2002).

*The liquid to vapor phase transition in excited nuclei*, J. B. Elliott *et al.*, Phys. Rev. Lett. **88**, 042701 (2002).

*Statistical signatures for critical behavior in small systems*, J. B. Elliott *et al.*, Phys. Rev. C **62**, 064603 (2000).

*Nuclear multifragmentation, percolation, and the Fisher droplet model: Common features of reducibility and thermal scaling*, J. B. Elliott *et al.*, Phys. Rev. Lett **85**, 1194 (2000).

*Standard thermodynamic quantities as determined via models of nuclear multifragmentation*, J. B. Elliott and A. S. Hirsch, Phys. Rev. C **61**, 54605 (2000).

*The search for the scaling function in the multifragmentation of gold nuclei*, J. B. Elliott *et al.*, Phys. Lett. B **418**, 34 (1998).

*Scaling behavior in very small percolation lattices*, J. B. Elliott *et al.*, Phys. Rev. C **55**, 1319 (1997).

*Comment on "Pre-equilibrium particle emission and critical exponent analysis"*, J. B. Elliott *et al.*, Phys. Rev. C **55**, 544 (1997).

*Individual fragment yields and determination of the critical exponent  $\sigma$* , J. B. Elliott *et al.*, Phys. Lett. B **381**, 35 (1996).

*Gilkes et al. reply for the EOS Collaboration*, M. L. Gilkes *et al.*, Phys. Rev. Lett **75**, 768 (1995).

*Determination of critical exponents from the multifragmentation of gold nuclei*, M. L. Gilkes *et al.*, Phys. Rev. Lett. **73**, 1590 (1994).

*Extraction of critical exponents from very small percolation lattices*, J. B. Elliott *et al.*, Phys. Rev. C **49**, 3185 (1994).

#### **Publications: contributing author**

*The three-dimensional Ising model: A paradigm of liquid-vapor coexistence in nuclear multifragmentation*, C. M. Mader *et al.*, submitted to Phys. Rev. Lett. (2001).

*Comparison of 1A GeV  $^{197}\text{Au} + \text{C}$  data with thermodynamics: The nature of the phase transition in nuclear multifragmentation*, R. P. Scharenberg *et al.*, Phys. Rev. C **64**, 054602 (2001).

*Thermal phase transition in nuclear multifragmentation: The role of Coulomb energy and finite size*, B. K. Srivastava *et al.*, Phys. Rev. C **64**, 041605(R) (2001).

*Negative heat capacities and first order phase transitions in nuclei and other mesoscopic systems*, L. G. Moretto *et al.*, submitted to Phys. Rev. Lett. (2000).

*Two-stage multifragmentation of 1A GeV Kr, Lr and Au*, J. A. Hauger *et al.*, Phys. Rev. C **62**, 024616 (2000).

*Comparison of the 1A GeV Au+C-197 interaction with first stage transport codes*, B.K. Srivastava *et al.*, Phys. Rev. C **60**, 064606 (1999).

*Multifragmentation of the remnant produced in the reaction of 1 AGeV gold with carbon*, J. A. Hauger *et al.*, Phys. Rev. C **57**, 764 (1998).

*Dynamics of the multifragmentation of 1A GeV gold on carbon*, J. A. Hauger *et al.*, Phys. Rev. Lett. **77**, 235 (1996).

#### **Presentations: invited**

November 2001      *Building the phase diagram of nuclear matter*, Heavy Ion Discussion Group, Argonne National Laboratory, Argonne, IL

November 2001      *Building the phase diagram of nuclear matter*, Heavy Ion Reactions and Matter under Extreme Conditions; National Superconducting Cyclotron Laboratory, Michigan State University, East Lansing, MI

May 2001            *Evidence for the liquid to vapor transition in excited nuclei*, Nuclear Science Division Monday Morning Meeting, Lawrence Berkeley National Laboratory, Berkeley, CA

March 2001	<i>Evidence for the liquid to vapor transition in excited nuclei</i> , Nuclear Physics Forum, Lawrence Berkeley National Laboratory, Berkeley, CA
September 2000	<i>Evidence for critical behavior in the fragment yields of Au, La and Kr</i> , Two week meeting in Trento on Phase Transitions in Finite Systems; European Centre for Theoretical Studies in Nuclear Physics and Related Areas, Trento, Italy
June 2000	<i>Experimental results for the multifragmentation of Au, La and Kr: Thermal scaling, <math>\sigma</math> and <math>c_0</math></i> , 2000 Gordon Research Conference on Nuclear Chemistry, Colby-Sawyer College, New London, NH
December 1999	<i>A comparison of the multifragmentation systematics in three different systems: Au, La and Kr</i> , Nuclear Physics Seminar, University of California-Davis, Davis, CA
November 1999	<i>Thermal scaling in percolation and the multifragmentation of gold nuclei</i> , Nuclear Science Division Monday Morning Meeting, Lawrence Berkeley Laboratory, Berkeley CA
November 1999	<i>Percolation phenomena: a broad-brush introduction with some applications in the analysis of nuclear physics experiments</i> , Heavy Ion Tea, Lawrence Berkeley National Laboratory, Berkeley, CA
January 1999	<i>An examination of system size effects in the nuclear liquid-gas phase transition</i> , Fifteenth Winter Workshop on Nuclear Dynamics, Park City, UT
December 1998	<i>Elementary Thermodynamics in Models of Nuclear Multifragmentation</i> , Lawrence Berkeley National Laboratory, Berkeley, CA
November 1998	<i>Thermodynamics in Nuclear Physics Models</i> , Departmental Colloquium, Purdue University-Calumet, Calumet, IN
October 1998	<i>Thermodynamics in Nuclear Physics Models</i> , Food and Drug Administration, Washington, D.C.
April 1998	<i>Statistical signatures for critical behavior in small systems</i> , Mini-symposium on the nuclear liquid-gas phase transition: The 1998 Spring Meeting of the American Physical Society, Columbus, OH
March 1998	<i>The determination of critical exponents and the scaling function from the multifragmentation of Gold nuclei at 1 AGeV</i> , Workshop on nuclear matter in different phases and transitions, Ecole de Physique, Les Houches, France
April 1997	<i>Statistical Evidence for a Liquid-Gas Type Phase Transition in Nuclear Matter</i> , Nuclear Physics Seminar, University of Kentucky-Lexington, KY

- February 1997 *Statistical Evidence for a Liquid-Gas Type Phase Transition in the Multifragmentation of Gold Nuclei*, Thirteenth Winter Workshop on Nuclear Dynamics, Marathon, The Keys, FL
- October 1996 *Statistical Mechanics and Thermodynamics of Nuclear Multifragmentation*, Nuclear Physics Seminar, University of Illinois at Urbana-Champaign
- October 1996 *Statistical Mechanics and Thermodynamics of Nuclear Multifragmentation*, The 1996 Fall Meeting of the American Physical Society Division of Nuclear Physics, Massachusetts Institute of Technology, Cambridge, MA
- December 1995 *Determination of critical exponents in finite systems*, Workshop on Phase Transitions in Small Systems, Gesellschaft für Schwerionenforschung, Darmstadt, Germany
- November 1994 *Search for Signals of a Phase Transition in the Multifragmentation of Gold Nuclei*, Institut de Physique Nucleaire, Orsay France
- November 1994 *The Search for Signals of a Phase Transition in the Multifragmentation of Gold Nuclei*, Gesellschaft für Schwerionenforschung, Darmstadt, Germany

**Presentations: contributed**

- July 2001 *The coexistence curve of charged finite nuclear matter*, International Nuclear Physics Conference, University of California, Berkeley CA
- November 2000 *Evidence for liquid-gas coexistence in nuclear multifragmentation mass yields*, American Physical Society Division of Nuclear Physics Long Range Plan Town Meeting, Oakland, CA
- October 1999 *A comparison of the multifragmentation systematics in three different systems: 1 AGeV Au + C, 1 AGeV La + C and 1 AGeV Kr + C*, The 1999 Annual Meeting of the American Physical Society Division of Nuclear Physics, Asilomar Conference Center - Orange Grove, CA
- October 1998 *The Investigation of Standard Thermodynamic Quantities as Determined via Models of Nuclear Multifragmentation*, The 1999 Annual Meeting of the American Physical Society Division of Nuclear Physics, Santa Fe, NM
- February 1997 Panelist, Science and Education: What science should be taught and what should be taught about science, to the public and to scientists? Science and It's Critics: The Practice of Science, Kansas University-Lawrence, KS
- January 1997 *Statistical Evidence for a Liquid-Gas Type Phase Transition in Nuclear Matter*, Theoretical Science Seminar, University of Oregon-Eugene, OR

December 1996	<i>Experimental Evidence of a Liquid-Gas Phase Transition in Excited Gold Nuclei</i> , 76 <sup>th</sup> Statistical Mechanics Conference, Rutgers University, Rutgers, NY
May 1996	<i>Scaling Behavior in the Nuclear Multifragmentation of 1.0 AGeV Au + C</i> , The 1996 Spring Meeting of the American Physical Society Division of Nuclear Physics, Indianapolis, IN
October 1995	<i>Evidence for the Nuclear Matter Scaling Function and the critical exponent <math>\sigma</math></i> , The 1995 Fall Meeting of the American Physical Society Division of Nuclear Physics, Indiana University-Bloomington, IN
October 1993	<i>Searching for Critical Exponents in Nuclear Multifragmentation Data</i> , The 1993 Annual Meeting of the American Physical Society Division of Nuclear Physics, Asilomar Conference Center - Orange Grove, CA
September 1993	<i>A Critical Analysis of Nuclear Multifragmentation</i> , NATO Advanced Study Institute Hot and Dense Nuclear Matter, Bodrum, Turkey
October 1992	<i>Extraction of Critical Exponents from Nuclear Multifragmentation</i> , Fluctuations in Dynamical Heavy Ion Collisions Workshop, GANIL; Caen, France

February, 2002